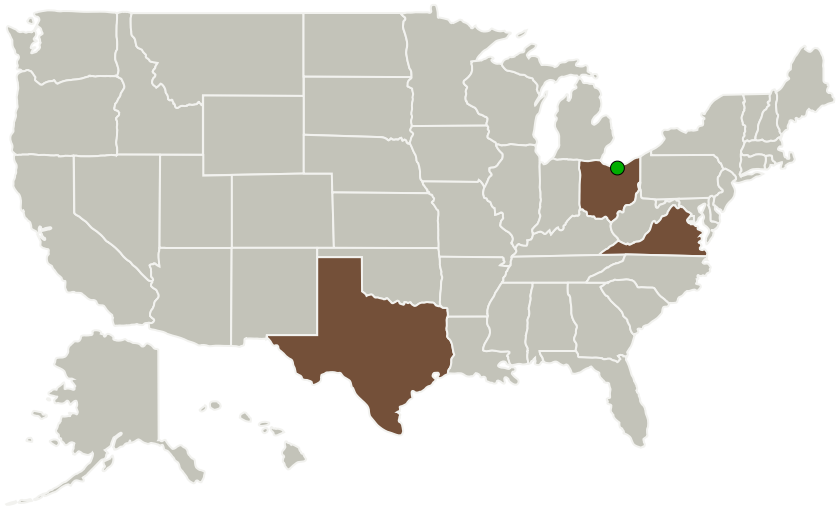
Physics-Based Modeling Tools for Life Prediction and Durability Assessment of Advanced Materials, Phase II

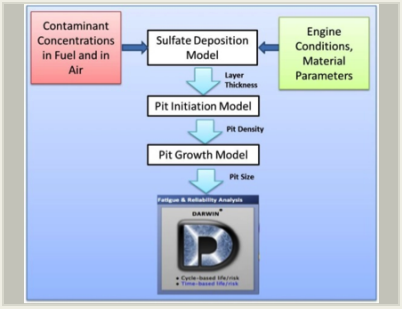
Completed Technology Project (2015 - 2018)

Project Introduction

The technical objectives of this program are: (1) to develop a set of physics-based modeling tools to predict the initiation of hot corrosion and to address pit and fatigue crack formation in Ni-based alloys subjected to corrosive environments, (2) to implement this set of physics-based modeling tools into the DARWIN probabilistic life-prediction code, and (3) to demonstrate corrosion fatigue crack initiation and growth life prediction for turbine disks subjected to low-cycle and high-cycle fatigue loading in extreme environments. This technology will significantly improve the current ability to simulate and avoid corrosion fatigue failure of engine disks or metallic structural components due to prolonged exposure to extreme environments at elevated temperatures. Completion of the proposed program will provide probabilistic corrosion fatigue crack growth life assessment software tools for structural components subjected to aggressive hot corrosion environments. Such a suite of software tools is unique and is urgently needed for designing and improving the performance of critical structures used in the space structure and propulsion systems in commercial and military gas turbine engines, and oil and gas industries. This generic technology can also be used to provide guidance for developing new alloys or improving current Ni-based alloy designs for hot-section applications.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Elder Research, Inc.	Lead Organization	Industry	Charlottesville, Virginia
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio
Southwest Research Institute - San Antonio(SWRI)	Supporting Organization	Academia	San Antonio, Texas

Primary U.S. Work Locations	
Ohio	Texas
Virginia	

Project Transitions

June 2015: Project Start

March 2018: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137673)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Elder Research, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

William Goodrum

Co-Investigator:

Andrew H Fast

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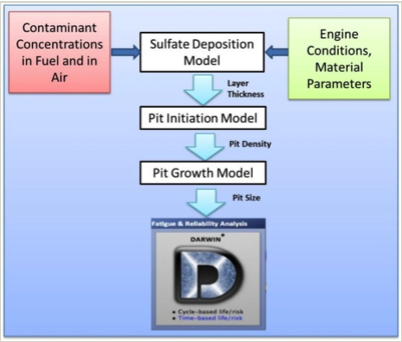
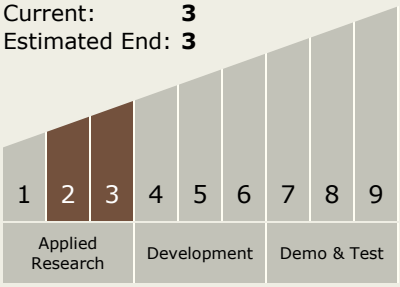
Images



Briefing Chart Image
Physics-Based Modeling Tools for Life Prediction and Durability Assessment of Advanced Materials, Phase II
(https://techport.nasa.gov/image/128506)

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.2 Structures
    - TX12.2.3 Reliability and Sustainment

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System